

Homework 1 Solutions

1.264

Fall 2002

This is a solution in outline form only, and it does not cover all pages and details. It only defines the core functions and screens. This may make my resource estimates too low; if yours are more detailed, they are likely to be better. That is part of what this homework shows.

I chose a very simple user manual format; again, it's only in outline form—your homework should be more complete. It also comments on the system in a way that a user manual would not—I'd do this differently if it wasn't a homework solution. A text solution would describe the inputs and outputs in more detail, instead of using charts. A scenario solution would be similar, but would be organized around the processes rather than the screens; it would contain roughly the same material but in a different organization.

This solution is an example only; you may have chosen quite different requirements. That is fine, as long as they solve the problem and have reasonable scope.

A. Web site: home page

1. The aircraft maintenance system (AMS) is a Web-based application that allows customers to place orders for work on aircraft.
 - a. AMS will schedule and price the work and provide status information.
 - b. AMS allows your employees to manage your aircraft, engine, order and customer data
2. Home page: Hyperlinks are underlined.
 - a. Users can go to:
 - i. marketing info (which will be contact us, about us, feedback, news),
 - ii. services (a list of services: maintenance, avionics, interior, painting, testing), and
 - iii. prices (for each service).
 - b. External users can place orders and check status.
 - c. Internal users will go to a login page.

<u>Home</u>	
<u>About us</u>	
<u>Contact us</u>	
<u>Feedback</u>	
<u>News</u>	Welcome to MIT
<u>Maintenance</u>	Aero Services
<u>Avionics</u>	
<u>Interior</u>	
<u>Paint</u>	Text, pictures for home page
<u>Testing</u>	
<u>Prices</u>	
<u>Orders</u>	
<u>Order status</u>	
<u>Internal users</u>	

3. The marketing info will be several hyperlinks:
 - a. 'About us' is a text page with company info
 - b. 'Contact' lists phone numbers, addresses and a map
 - c. 'Feedback' has an email form that can be sent to the company
 - d. 'News' contains information the company adds occasionally
 - e. There is no site search page (there are security problems with the Microsoft implementation available to us, so we don't use it)
4. The services list is maintenance (aircraft and engine), avionics (electronics), interior, paint and testing. Each of these is a hyperlink that describes the service in more detail.
5. The price list is a table with prices. This is much simpler than it would be in real life.
6. The orders and status hyperlink takes the external user to a series of pages described below.
7. The internal users hyperlink goes to a login page. The login page contains the username and password.
 - a. If login is successful, the user is taken to the internal user home page.
 - b. If login is not successful, the user is returned to the login page with an error message. (This is simpler than in real life)

B. Placing orders

1. The external user is shown a login page, which has text boxes for username and password. If the user doesn't have a username and

password, there are text boxes to enter customer name and address, and password. The customer name and address are checked against the aircraft table in the database and, if there is a match, an account is created. The password is stored in the database securely. There are no provisions for forgotten passwords; the user must call the maintenance company and an internal user can blank the password, and then the user can reset it.

2. The external user is taken to a page with an order header. She fills out all the overall information about the order. See parts D and F.4 of homework 1 for more information on these fields.

Customer name:
Company name:
Address:
City:
State:
Zip:
Office Telephone:
Hangar Telephone:
Email:
Aircraft number:
Aircraft model:
Aircraft serial number:
Date (week) service requested:

[Next]

3. There is a 'next' button on the page that takes the external user to the set of services to be ordered. The next page displays with the order number at the top (assigned by AMS) and obtains order detail. It displays the customer name and aircraft number for convenience, to minimize confusion. The system displays a blank 'next' page when the 'next' button is pushed. The user can go back and edit a previous page by pushing the 'previous' button. This allows for an arbitrary number of maintenance activities per order.

Order number: (system generated)

Customer name: (from previous page)

Aircraft number: (from previous page)

Enter service type: (pulldown: maint, interior, paint, avionics, test)

Enter quantity: (usually 1, but can be multiple engines, tests)

Enter comments: (free format in text box)

[Next] [Previous] [Complete]

4. When the user hits 'complete' AMS takes her to a summary page, shown below. The 'Complete' page shows header information on the top, as well as computing the prices for each service and the order total:

Order number:

Customer name:

Aircraft number:

Maintenance service	Qty	Price	Extended price
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(As many rows as needed generated on Web page)

Order subtotal:

Tax:

Order total:

Week service requested: _____

Week service can be scheduled: _____ or _____ or _____

(System generates up to 3 alternate weeks if requested week not available)

5. The system checks whether there are sufficient maintenance resources to meet the order in the requested week. If there are the 'week service can be scheduled' is the same as the 'week service requested' in the Web page

above. The 'week service requested' has to be greater than the current week, in any case. If there aren't sufficient resources in the requested week, the system suggests the 3 closest weeks with resources. (This can be simplified during design if this is difficult—the requirement is to show some alternate weeks). While it would be best to show resource unavailability at the start, it's not possible to know whether there are enough resources until all the maintenance items have been specified, which only occurs at this point.

6. The user may either accept or edit the week. If the week is available, the next page (not shown) takes payment information. If the week is not available, the same page is shown and the user makes another choice of week, or cancels.
7. If the user 'submits' the payment information page, the next page (not shown) confirms the payment information and has a hyperlink back to the home page.
8. Order status query: This Web page is not shown. The user can hit the 'order status' hyperlink on the home page, and, after the login sequence described in 1. above, is presented with a page with all of her orders. If a customer has a very large number of orders, this would be awkward, but this is not expected in AMS.

C. Internal Users

1. The internal users select this hyperlink from the home page. They go through the same login sequence as the external users, except that their names, addresses and other info are not in the aircraft database. A separate table of internal users, passwords and other administrative information is required.
2. Internal users are then presented a page to access all the database tables in the system. In the simple version built in our homeworks, only 4 tables are presented: aircraft, engines, aircraft types and orders. Access to all tables is presented this way, even if others are later added.

Aircraft	Aircraft types
<u>View all aircraft</u>	<u>View all aircraft types</u>
<u>Add aircraft</u>	<u>Add aircraft types</u>
<u>Delete aircraft</u>	<u>Delete aircraft types</u>
<u>Modify aircraft</u>	<u>Modify aircraft types</u>
Engines	Orders
<u>View all engines</u>	<u>View all orders</u>
<u>Add engines</u>	<u>Add orders</u>
<u>Delete engines</u>	<u>Delete orders</u>
<u>Modify engines</u>	<u>Modify orders</u>

3. The “view all” hyperlink in the page above leads directly to a results page in which all aircraft are listed.
4. The “add” hyperlink leads to a new page (not shown) in which there are text boxes for all the data fields for an aircraft, and ‘submit’ and ‘cancel’ buttons at the bottom of the page. The page checks that the N number is unique (primary key) and that other data is valid (to be defined in the data model). If the input is valid, the row is added to the database. If not, an error page is displayed with a hyperlink to return to the page above.
5. The “delete” hyperlink leads to a new page (not shown) in which the primary key is entered in the text box (aircraft N number, aircraft type, engine type, order number). There are ‘delete’ and ‘cancel’ buttons at the bottom of the page. If the key is present, the row is deleted from the database. If not, an error page is displayed with a hyperlink to return to the page above.
6. The “modify” hyperlink leads to a new page (not shown) in which the primary key is entered in the text box. After it’s entered and the row is retrieved, a form like the “add” form is shown, except with all the text boxes filled in with the current values. The user may type over them (except for the primary key). There are ‘submit’ and ‘cancel’ buttons at the bottom of the page. Error pages are shown if the primary key is not found or if there is an invalid modification.

7. The data in the aircraft, aircraft type, engine type tables is as defined in the homework 1 statement; the data will be modeled and modified in homework 2. The order data contains the fields from the order pages shown above: there will be order header and order detail tables.
8. Aircraft data that is changed through maintenance procedures (for example, changing the engine type) must be manually edited by an internal user.
9. Order status changes are manually entered by internal users. The status codes are 'initial', 'in progress', 'completed' and 'aircraft departed'.
10. If a part cannot be obtained in time to do maintenance the next week, the internal user must find the record, call the customer and manually change the work date or cancel the order.

D. Size Estimation

- 1) To estimate the size of the system, we count function points:

Web inputs:

Low complexity: Login-external, login-internal, internal user db access 'home', 4 view table, 4 delete table

Medium complexity: Order header

High complexity: Order detail, summary, payment, 4 add table, 4 modify table

Web outputs:

Low complexity: home page, about, contact, feedback, news, 5 services, price, order confirmation

Web inquiries:

High complexity: Check order status

We estimate 20 tables for now; we will know that better in homework 2. We have no external interfaces, messages, etc We assume they are medium complexity for now.

Thus, our function points are:

Program unit	Low	Medium	High
Web inputs	11 x 3 = 33	1 x 4 = 4	11 x 6 = 66
Web outputs	12 x 4 = 48	0	0
Web queries	0	0	1 x 6 = 6
Database tables	0	20 x 10 = 200	0
Total			357

- 2) Estimate lines of code.

Program unit	Tool	Lines/function point
Web inputs, outputs, queries	FrontPage	10 (code generation)
Windows inputs, outputs, queries	Visual Basic	10 (code generation)
Database	Access (SQL)	10 (code generation)

The total lines of code is approximately 3600. The assumptions are too optimistic for a commercial product, but are reasonable for a class project using tools and not handling errors, special cases, etc. If you used the numbers in the McConnell table, you'd get about four times as many lines. Either answer is ok.

3) Estimate person months.

Using table 8-10, Nominal Schedules for Business Products, the lowest entry is 10,000 lines of code, with 6 schedule months and 9 person months. With a system 36% this size, the person months will be less than 36% of 9 months. An estimate of 30% is reasonable, or about 2.7 person months.

4) Estimate schedule months.

Using table 8-10, the 6 schedule months for 10,000 lines will be reduced for a project of 3,600 lines, but not proportionally. Using an exponent of 0.4 (table 8-7), a project that is .36 of the effort should take about $(.36)^{0.4}$ time, or about 0.66 the time. The 6 schedule months thus becomes about 4 months.

5) Team size

(This is not required in the homework, but it's good to look at it.)

With 2.7 person months over 4 schedule months, the average team size is about .6 persons, or 24 hours/week. With a three person team, this would be consistent with the class effort. Unfortunately, the homeworks are scheduled over about a 2.5 month period, so this will be difficult. With this set of requirements, you could eliminate some features right now; you could implement improved process (efficient schedules), etc. For now, don't change anything, but we will reduce what your systems do in the following homeworks, as mentioned in class, to match the resources better.

6) Ranges

At this point, we have an initial project definition. Our estimate of effort is between 0.25 and 4.0 times the point estimate, so it's between 0.7 and 10.8 person months. Our estimate of schedule is between 0.6 and 1.6 times the 4 schedule months of our point estimate, so the range is between 2.4 and 6.4 schedule months.

7) Conclusion.

Even at this level of detail, you should be concerned with the resources and schedule. We will reduce the work in this class from that defined in this solution, and you should have done the same in your requirements.

We will not implement a number of the requirements in the, and we will not have as many database-related functions as a true commercial system would have.